

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE INSTALLATION GUIDELINES

FENCE

(Feet)
CODE 382

Installation of Fence 382 shall adhere to the South Dakota Natural Resources Conservation Service (NRCS) conservation practice standard in the South Dakota Technical Guide.

The General-Purpose Fence is designed to contain or control movements of livestock in most cases.

The Protective Fence is designed for use where a high degree of protection is desired.

The size, gauge, amount, weight, or type of materials specified for each fence type shall be regarded as minimums, unless otherwise specified. Post seating depths shall be regarded as minimums. Post spacing and wire spacing shall be regarded as maximums, unless otherwise specified.

All materials used in construction of a fence will be new or like new. Any materials or construction features that exceed these specifications, or that are of different designs that are of equal or greater effectiveness, are acceptable for meeting specifications. Questionable materials or construction features require prior approval of the state resource conservationist.

GENERAL-PURPOSE FENCE (3 or 4-wire barbed, and woven-wire)

For construction details, see South Dakota Conservation Job Sheet 1.

Materials

- A. Barbed wire
 - 1. Standard weight: double-strand galvanized wire of 12.5 gauge with two-point 14 gauge wire barbs at a spacing of approximately 4 to 6 inches.
 - 2. High-tensile strength (110,000 psi): double-strand galvanized wire of 15.5 gauge with two-point 16.5 gauge barbs at a spacing of 4 to 6 inches.
- B. Woven wire
 - 1. Standard weight: 26 to 34 inches high netting with 11 gauge top and bottom wires, 14.5 gauge intermediate and stay wires, all galvanized. Mesh size can be 6 inch by 6 inch or 6 inch by 12 inch. Twelve-inch mesh is recommended for goats to reduce hang-up.
 - 2. High-tensile strength: 42-inch netting with 12.5 gauge high-tensile strength (179,000 psi) line wires, 12.5 gauge medium-tensile strength (125,000 psi) stay wires, all galvanized. Mesh will be 4 inch by 6 inch to 7 inch by 12 inch.
- C. Wood posts: All decay-susceptible wood posts (such as pine) must be treated with proper chemical preservatives for below-ground application (i.e., creosote or pentachlorophenol). Posts made from rot-resistant woods such as red cedar or Rocky Mountain juniper are suitable without treatment, however, at least half the diameter on the small end of the post should be heartwood.
 - 1. Line posts: 3-inch diameter, 6-foot length, sound, and reasonably straight.
 - 2. Corner, gate, and in-line brace posts: 5-inch diameter, 7-foot length, straight and sound, wood. Sound railroad ties are acceptable.
- D. Steel posts: length, 5.5 feet; weight, 1.25 pounds per foot (excluding anchor plate); must have knobs, studs, or grooves for holding wire in place; must be equipped with a sturdy anchor plate firmly attached.

E. Brace material

1. Braces: straight and sound 4 inch by 4 inch by 8 foot treated lumber or 4-inch diameter post of 8-foot length or 2 3/8 inch by 8-foot galvanized steel pipe, with a wall thickness of .125 inch. Braces will be securely attached to the vertical posts.
2. Wire: either of the following
 - a. Galvanized, double-strand 12.5 gauge
 - b. Galvanized, single-strand 9 gauge

F. Wire fasteners

1. Staples: 9 gauge wire staples, 1 3/4 inches long for softwoods, 1 1/4 inch length for high-density hardwoods.
2. Ties and/or clips: made especially for the particular style of post used or #12 galvanized wire.

G. Stays: galvanized, twisted, wire stays shall be long enough to hold each fence wire at specified spacing.

Construction

A. Post seating depth: all posts should be set deep enough to gain maximum sturdiness consistent with soil conditions. Set posts to the following depth under normal conditions:

1. Line posts
 - a. Wood: 2 feet
 - b. Steel: 1.5 feet
2. Corner, in-line brace, and gate posts will be wood, seated at least 3-feet deep.

B. Line post spacing

1. Barbed-wire fence
 - a. Up to 20 feet without stays.
 - b. Up to 30 feet with at least one stay. Stays must divide the space between posts about equally.
2. Woven-wire fence: up to 20 feet.

C. Alignment: construction should be as straight as possible between corners or turns. Fence construction along curved lines should be in straight segments with in-line bracing at appropriate angles. Sound railroad ties or 5 inch by 7 foot posts set at a depth of 3 feet are adequate for bracing many of these turns, especially where the angles are wide and the segment of fence is short.

D. Bracing and anchoring: when fencing over uneven terrain, the fence shall be adequately anchored at low spots should include #3 from the Power Fence page IG-382-5.

1. In-line brace and end (gate) brace assemblies: install at 1,320-foot intervals or closer, between corners or other major turns. Set two posts about 8 feet apart with top timber between the two, and diagonal wires from the base of each to the top of other posts. A diagonal style brace may be used in place of the standard H-style brace. Refer to South Dakota Conservation Job Sheet 382-4.
2. Corner braces: set brace a minimum of 8 feet from the corner with top timber between the posts, with one diagonal wire wrapped and twisted from the top of the brace post to the bottom of the corner post. A diagonal style brace may be used in place of the standard H-style brace. Refer to South Dakota Conservation Job Sheet 382-4.

- E. Wire placement: wire will be double-wrapped and stapled at all corners, in-line brace post assemblies, and gate posts.
1. Barbed wire
 - a. Three-wire: attach top wire at least 42 inches above ground level at post locations. Attach middle and bottom wires so wire-to-wire and wire-to-ground intervals are all about equal.
 - b. Four or more wire: same as above, except operator may attach some wires closer together at their discretion, based on types of livestock involved.
 2. Woven wire
 - a. Netting will be supplemented with a barbed wire attached approximately 3 inches above it. Attach bottom wire of netting about 2 inches above ground level at post locations.

PROTECTIVE FENCE

For details, see SD Conservation Job Sheet 382-2. Construct standard protective fences by the same method and design as specified for General-Purpose Fence except for the following variations:

Materials

- A. Line posts
1. Wood: 4-inch diameter, length 6.5 feet
 2. Steel: 6-foot length, weight of 1.25 pounds per foot, excluding anchor plate

Construction

- A. Post seating depth: all posts should be set deep enough to gain maximum sturdiness consistent with soil conditions. Set posts to the following depth under normal conditions:
1. Line posts
 - a. Wood: 2.5 feet
 - b. Steel: 2 feet
- B. Line post spacing
1. Sixteen feet; wood at least every third post: applicable for barbed and woven-wire protective fence
- C. In-line bracing and anchoring
1. Maximum 825-foot interval.
- D. Wire
1. Four-barbed wires with top wire at least 42 inches above the ground. Lower wires to be spaced at the discretion of the operator, based upon types of livestock to be excluded.
 2. Woven wire will have at least one barbed wire attached approximately 3 inches above the top of the woven wire.

POWER FENCE

For construction details, see South Dakota Conservation Job Sheet 382-3.

Power fences erected in areas of potential high public use should be properly signed.

Wire

A. Type: use smooth, single-strand, 12.5 gauge high-tensile strength (170,000 psi, minimum), type III galvanized or better.

B. Placement

1. A single, hot wire may be used in situations where the earth will provide an adequate ground to complete the circuit back to the energizer. This single, hot wire should generally be located 24 to 32 inches above the ground line for cattle (cows) and at the nose height of the animal to be controlled when it is walking for other species and age classes.

2. For two or more wires alternate ground and hot wires. The ground wires will be connected either directly to the negative side of the energizer or to the same grounding rod as the energizer. Listed below are suggested wire spacing (first distance is from ground level) and polarities for typical power fence uses.

Wire No.	Use	Spacing and Polarity
2	Cattle cross fence	20"(-), 10"(+)
3	Cattle cross fence	22'(+) , 10"(-), 10"(+)
3	Horses	28"(+) , 10"(-), 10"(+)
3	Hogs	6"(+) , 8"(-), 10"(+)
4	Cattle boundary	12"(-), 10"(+), 10"(-), 10"(+)
5	Cattle boundary	12"(+) , 6"(-), 10"(+), 10"(-), 10"(+)
5	Cattle feedlot	14"(+) , 8"(-), 8"(+) , 10"(-), 10"(+)
5	Horse boundary	18"(+) , 6"(-), 6"(+) , 8"(-), 10"(+)
5	Sheep, goat boundary	6"(+) , 6"(-), 6"(+) , 8"(-), 10"(+)
5	Buffalo	20"(+) , 10"(-), 10"(+) , 10"(-), 10"(+)
6	Sheep, goat boundary	6"(-), 6"(+) , 6"(-), 6"(+) , 8"(-), 10"(+)
7	predator exclusion	
	Sheep, goat boundary	6"(+) , 6"(-), 6"(+) , 6"(-), 6"(+) , 8"(-), 10"(+)
	predator exclusion	

C. Tension: tension on each wire shall be sufficient to maintain proper wire spacing between line posts. In-line strainers will be installed on each wire to maintain correct tension on each wire between all brace corners and gate assemblies. Tension springs may be used on each wire to maintain proper tension.

Line posts

A. Material

- Fiberglass T-posts will be a minimum of 1 inch by 1 inch with notches to allow proper wire spacing. Fiberglass rods will be a minimum of 7/8 inch diameter with notches or holes located for proper wire spacing.
- Self-insulating wood posts will have a diameter of 1.5 inches or larger. Posts must be treated or made from rot-resistant wood.
- Steel posts will weigh one pound per foot, excluding anchor plate, and have a firmly attached anchor plate.

B. Placement requirements

1. Posts will be driven a minimum depth of 16 inches, except in sand where 24 inches may be required.
2. For three or more wire power fences, line posts are not to exceed 75-foot centers without stays, or 100-foot centers with stays on 50-foot centers between line posts. Generally, posts are spaced to maintain desired wire spacing.
3. For single-wire and two-wire power fences, line posts are not to exceed 75-foot centers. Stays should not be used on two-wire power fences. Generally, posts are spaced to maintain desired wire spacing.

Corner, Gate, and Brace Assemblies

A. Materials and design will meet the same requirements as General-Purpose Fence.

1. For permanent power fences, the diagonal or H-style style corner may be used. Refer to South Dakota Conservation Job Sheet 382-4.
2. In-line brace assemblies will be spaced at intervals no greater than 4,000 feet on level terrain.
3. Over uneven terrain, provide additional bracing as needed between corner, gate, end, and brace assemblies to put vertical pull of fencing on brace posts instead of line posts. Use properly anchored posts of adequate size with attached deadmen in low spots. On rises, use wood posts of 4-inch diameter or larger to counteract downward pull.

Fence Alignment

Construction should be as straight as possible between corners or turns. Construction along curved lines should be done in straight segments with in-line bracing at appropriate angles. Sound railroad ties or 5 inch by 7 foot posts set at a depth of 3 feet are usually adequate for bracing these turns, especially where the angles are wide and the fence segment is short.

Fence Fasteners and Insulators

A. Materials

1. On wood posts and steel posts, use porcelain, ceramic, or high-quality, UV-stabilized polypropylene insulator to which the wire can be attached. Polypropylene insulators shall be of the type that provides adequate spacing from the post to prevent current leakage.
2. Use only manufacturer's recommended insulators at all points where tension from the wire is transferred to corner, gate, end, and brace posts.

B. Attachment

1. Attach wire to porcelain and ceramic insulators with the appropriate manufacturer's clip or use 12 gauge, galvanized wire.
2. Attach wire to fiberglass and self insulating wood posts and fiberglass rods, with the specifically designed manufacturer's fastener or "clip" or use 12.5 gauge galvanized wire tied in a loop to attach wire to post. Instead of using "clips" or wire ties, holes may be drilled in fiberglass rods. Holes should be drilled at the proper spacing. The line wire is not to be threaded through pre-drilled holes but will be attached with wire or proper fasteners. High-tensile strength wire is attached to the post using a short length of galvanized wire that is looped around the line wire, threaded through the hole in the post, and wrapped back around the line wire on either side of the post ("Cotter key" style fastener).

C. Stays: fiberglass or self insulating wood stays will be used.

- D. Energizers: electronic energizers or power-fence controllers shall be Underwriters Laboratory (UL)- listed. Installation shall be according to manufacturer's recommendations. The maximum length of wire per controller shall not exceed manufacturer's recommendation for size and type of wire used. Controllers will have the following features meet the following minimum specifications:
1. High-power, low-impedance with 5,000-volt peak output, a pulse that is finished within 1/3000 of a second, and 54-60 pulses per minute.
 2. High-impact, weather-resistant cases.
 3. Solid-state circuitry (snap-in circuit panels).
 4. Lightning arrester.
 5. Safety-pace fuse.
 6. Any of the following power requirements;
 - a. 110-volt
 - b. 220-volt
 - c. 12-volt battery-powered, capable of working three weeks without recharge.
- F. Electrical Grounding: all power fences must be properly grounded with galvanized ground rods per the energizer manufacturer's recommendation. Inadequate grounding is the leading cause of power fences' failure to control livestock.
- G. Insulated cable: to cross gates and other areas where the power fence is located some distance away from the energizer or controller, use 12.5 gauge insulated cable with 56 ohms or less of resistance per mile. Use galvanized wire with two layers of insulation for underground burial or overhead transmission. Where feasible, use overhead transmission to reduce the incidence of short-circuiting, which can occur with underground burial. Do not use copper, insulated wire due to corrosion factor and lack of tensile strength.

CHAIN-LINK FENCE

For use as protective fence where high-hazard risks need to be reduced (i.e., around waste storage structures, power generators, etc.).

Materials

- A. Wire
1. Fabric wire will be a minimum of 11.5 gauge 2-1/2 inch mesh, 48 inches high, with zinc coating or equivalent.
 2. Barbed wire: see General-Purpose Fence design section for barbed wire specifications.
- B. Posts
1. Line posts: galvanized steel with a minimum outside diameter of 1 1/2 inch, a length of 5.5 feet and a wall thickness of .08 inch.
 2. Corner posts: galvanized steel with a minimum outside diameter of 2 1/2 inch, a length of 6 feet and a wall thickness of .125 inch.
 3. Gate posts: galvanized steel with a minimum diameter and length to support the gate width needed according to the manufacturer's recommendations.
- C. Top rail
1. Will be galvanized steel pipe, or equivalent, with a minimum diameter of 1 1/2 inches with a wall thickness of .08 inch.
- D. Gates

1. Gates will be of the size necessary to allow for equipment access.
 2. Gates shall be installed according to manufacturer's recommendations.
 3. Gates may be single-swing or double-swing with the appropriate fittings for latches, stops, hinges, keepers, and other needed accessories. All materials will be steel with zinc coating or equivalent.
- E. Chain-link fence accessories
1. Caps, rail and brace ends, rail sleeves, wire ties and clips, brace bands, tension bands, tension bars, tension wire, barbed-wire support arms, and other accessories will be of steel and zinc coated as per manufacturer's recommendations. Install lock, latches, or chains where safety is a concern.

Construction

All chain-link fences will be constructed according to the manufacturer's recommendations and/or completed job sheets.

FENCE DESIGN FOR SPECIALIZED LIVESTOCK MANAGEMENT SYSTEMS AND OTHER ANIMALS

Managed Intensive Grazing

Prescribed grazing systems, where livestock are rotated rapidly through a series of varying sized temporary paddocks, may utilize single polywire electric fencing.

The wire, twine, tape, or rope shall contain a minimum of six mixed metal strands consisting of stainless steel and aluminum or tinned copper (all stainless steel strands are not adequate). Posts will be fiberglass, easily inserted into the ground, and have clips insuring easy attachment of the wire, twine, or tape. Post will generally be spaced about 40 feet apart. Wire height will be set at the height of the nose of the animal to be controlled when walking.

SMOOTH WIRE, NON ELECTRIC

In some instances Hi-Tensile non-electric smooth wire may be used as a substitute for barbed wire. Specifications for the wire should be the same as those previously described under "Power Fence" post kind, spacing, gate, and brace specifications should follow those described under "General Purpose Fence." The minimum number of wires will be six for cattle and nine for sheep in a grazing situation.

Bison

- A. Boundary fences: the specification for a standard protective fence will be used as the minimum design criteria for a boundary fence. Six-foot length, steel posts will be utilized in place of the standard 5.5-foot length, steel post. Wood posts will be 6.5 feet in length. Top wire should be set at 52 inches in height.
- B. Internal cross fences: the minimum design criteria are a standard three-wire barbed or two-wire power fence. Fences exceeding minimum criteria will be dependent on producer's need and management.

Elk

- A. Boundary fences: the minimum height will be 8 feet. Woven wire with a 6 inch by 6 inch even spacing or 3 inch to 7 inch variable spacing will be used. Seven feet of woven wire with at least two high tensile wires spaced 6 inches apart may also be used. Corner, gate, and inline brace posts will be treated wood and a minimum of 8 inch in diameter and 14 feet in length. Line posts will be treated wood with a minimum diameter of 6 inches and 12 feet in length. Maximum line post spacing will be 20 feet.
- B. Internal cross fences: the minimum height will be 6 feet. Woven wire with 6 inch by 6 inch even spacing or 3 inch to 7 inch variable spacing will be used. Five feet of woven wire with at least two high tensile wires spaced 6 inches apart may also be used. Corner, gate, and inline brace posts

and a minimum of 6 inches in diameter and 10 feet in length. Line posts will be treated wood and a minimum of 4 inches in diameter and 10 feet in length. Maximum line post spacing is 20 feet. Specifications for power fence may also be used. Power fences will be a minimum of 6 feet tall with seven wires spaced approximately 10 inches apart. Posts should be spaced no more than 45 feet apart with stays every 15 feet. A 6 inch diameter, 8-foot long treated wood line post should be installed every fourth post.

Deer

Boundary and internal cross fences: same requirement as for elk boundary fences except the minimum height will be 9 feet for both boundary and cross fences. Power fence will not be used.

Horses

To minimize or prevent injury: galvanized, barless wire of 12.5 gauge may be substituted for the barbed wire in a general-purpose or protective fence.

Antelope Crossing

Antelope seldom jump over or go through a fence, but will crawl underneath the fence. The adequate height for an antelope to crawl under is 16 to 18 inches. Wire spacings are different for cattle and sheep. These fences can be installed in full-length sections or in sections where antelope typically cross. See Diagram #1 Antelope Crossing.

Diagram # 1
Antelope Crossing

